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(54) Security Handset.

(57) A security device for use with a telephone handset having a microphone and an ear transducer is adapted to prevent eavesdropping while the handset is in an on hook position. The security device is comprised of switching means (115a,115b,116a,116b) disposed in the handset and adapted to disable the transducers. The switching means is switched to a first state when the handset is placed within a first predetermined orientation corresponding to a secure mode and is switched to a second state when the handset is placed within a second predetermined orientation corresponding to an operative mode. The individual switches (115a,115b,116a,116b) forming said switching means are held in position on a switch mounting assembly (100) comprised of a mounting block (110) disposed on a circuit board (111).

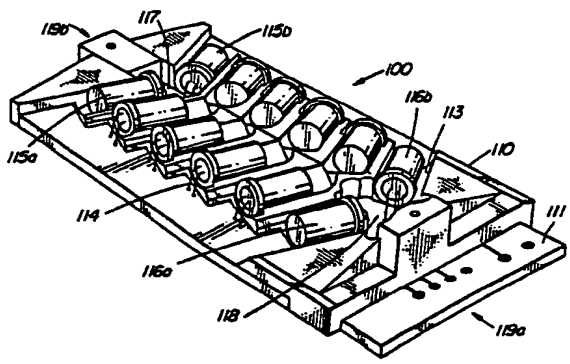

FIG. 11a

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SECURITY HANDSET

This invention relates to secure telephone systems but more particularly to a security device for use with a telephone handset to prevent eavesdropping while the handset is in an on-hook position.

One of the requirements of secure telephone systems, is that eavesdropping or bugging of the telephone be prevented when the telephone handset is in an on-hook position.

It was determined that eavesdropping could still be achieved even though the handset is in an on-hook position. The ear and microphone transducers of the telephone handset could be used to pick up and monitor a conversation.

A telephone security device for preventing use of an on-hook telephone for eavesdropping or bugging is disclosed in United States patent No. 3,715,514 which issued to Alan D. Bell. With this device, a voltage source is connected to the telephone line selector and hook switch through a dialled matrix and sensing relay coil. When the telephone is on-hook (that is with the hook switch open) all conductors from the telephone instrument are short circuited together and are disconnected from the telephone conductors leading out of a private or secure area in which the telephone is located. The short circuiting is accomplished by a plurality of relays responsive to the condition of the sensing relay. When the telephone is off-hook the conductors leading from the telephone are connected to the conductors leading from the area for normal conversational use. A lamp and photoresistor device is provided to isolate the annunciator from external conductors.

The problems associated with this system is that the use of relay coils and a diode matrix in a circuit design results in a relatively bulky and complex device which can be difficult to install and expensive to manufacture.

There is therefore a requirement for a telephone security device which is simple to use, easy to manufacture and which can be readily installed within the handset.

Accordingly, a first object of the present invention is to provide a security device for use with a telephone handset and which is relatively easy to install and inexpensive to manufacture.

Another object of the present invention is to provide a security device able to place the telephone handset in either an operative or secure mode depending on the orientation of the telephone handset.

Yet another object of the present invention is to provide a security device adapted to be placed in a telephone handset and which will short circuit the microphone and ear transducers and disconnect them from the main set when the handset is in the secure mode.

Accordingly, an aspect of the present invention is to provide a security device for use with a telephone handset having a microphone and an ear transducer, adapted to prevent eavesdropping while the handset is in an on-hook position, comprising: first switching means connected across said ear and microphone transducers; and second switching means connected in series with said ear and microphone transducers, such that when said handset is placed within a first predetermined orientation, corresponding to a secure mode, said first switching means becomes closed, shorting said ear and microphone transducers and said second switching means becomes open, and when said handset is placed within a second predetermined orientation, corresponding to an operating mode, said first switching means becomes open to enable said ear and microphone transducers, and said second switching means becomes closed.

Particular embodiments of the invention will be understood in conjunction with the accompanying drawings in which:

Figure 1 is a block diagram of the security device according to the preferred embodiment of the present invention;

Figures 2a to 2c illustrate the operational range of the security device when the telephone handset is in the secure mode;

Figure 3 is a sectional view of the security device mounting block of the present invention, taken along lines 3-3 of Figure 5;

Figure 4 is a sectional view of the mounting block taken along lines 4-4 of Figure 5;

Figure 5 is a side view of the mounting block;

Figure 6 is an illustrative view of a mercury switch used with the mounting block of Figure 3;

Figure 7 is a sectional view of a mercury switch receptacle taken along lines 7-7 of Figure 4;

Figure 8 is a sectional view of the mercury switch receptacle taken along lines 8-8 of Figure 7;

Figure 9 is a perspective view of a mounting block according to the another embodiment of the present invention;

Figure 10 is a partially sectioned view of a secure handset according to a preferred embodiment of the invention;

Figures 11a and 11b are perspective views of the mercury switch mounting assembly according to the preferred embodiment of the invention;

Figure 11c is a bottom view thereof; and

Figure 11d is a partially sectioned view of

the secure handset with the mounting assembly removed therefrom.

Referring now to Figure 1, we have shown a block diagram of the security device according to the present invention.

The security device is basically comprised of a number of position-sensing switches adapted to be disposed in a telephone handset (not shown). Depending on the orientation of the handset, the telephone is either in a secure mode or in an operative mode. As shown in Figure 1, these position-sensing switches are connected to the ear transducer 11 and microphone transducer 12 forming part of a telephone handset (not shown).

A first pair of position sensing switches PSS_1 and PSS_2 is connected across ear transducer 11. A second pair of position sensing switches PSS_7 and PSS_8 is connected across microphone transducer 12. Each pair is so disposed in the handset, as will be described further, such that each switch is closed when the handset is within the first range of predetermined orientations, corresponding to the secure mode whereas at least one switch in each pair is open when the handset is within a second range of predetermined orientations corresponding to the operating mode.

A third pair of position sensing switches PSS_3 and PSS_4 is connected in series with terminal 18 of ear transducer 11. A fourth pair of position sensing switches PSS_5 and PSS_6 is connected in series with terminal 20 of ear transducer 11.

A fifth pair PSS_9 and PSS_{10} is connected in series with terminal 23 of microphone transducer 12 and a sixth pair PSS_{11} and PSS_{12} is connected in series with terminal 24 of microphone transducer 12.

The third, fourth, fifth and sixth pair of position sensing switches are so disposed in the handset such that each switch is open when the handset is within the first range of predetermined orientations corresponding to the secure mode whereas at least one switch in each pair is closed when the handset is within the second range of predetermined orientation corresponding to the operating mode.

Referring now to Figures 2a to 2c, we have shown three series of movements which allow the secure device of the handset to change from a secure mode to an operating mode. The handset 30 is in a secure mode when the angle the longitudinal axis of the handset makes with the horizontal plane extends between 0 and a first predetermined angle. In Figure 2a, the longitudinal axis of the handset is defined by a phantom line 32 which extends between the ear and microphone ends 33 and 34 respectively, of the handset 30. The horizontal plane is defined by line 31. Beyond this first predetermined angle, the handset should change from a secure mode to an operative mode.

Similarly, as shown in Figures 2b and 2c, the handset is within the first range of predetermined orientations corresponding to a secure mode, when the angle the lateral axis of the handset makes with the horizontal plane extends between 0 and a second predetermined angle. The lateral axis of handset 30 is defined by a line extending perpendicular to the longitudinal axis and parallel to the horizontal plane. In Figure 2b and 2c this lateral axis is illustrated at reference numeral 35. Beyond this second predetermined angle, the handset should change to an operative mode.

Figures 3 to 5 will be used to describe the position-sensing switch mounting block 40 which is adapted to retain each switch in a predetermined position and orientation. The mounting block is designed to be installed in the handset. The mounting block is generally rectangular and is defined by a top surface 41, a bottom surface 42, a first end 43, a second end 44, a first longitudinal side 45 and a second longitudinal side 46.

The mounting block is adapted to be installed in the telephone handset 30, see Figures 2a to 2c, with end 43 pointing towards the ear transducer 33 and end 44 pointing towards the microphone transducer 34. The top surface should face outwardly away from the transducers, i.e. facing the convex side of the handset.

The mounting block is provided with a plurality of receptacles a - f and a′ - f′ on each of said first and second longitudinal sides 45 and 46. Each is adapted to receive a position-sensing switch in a predetermined arrangement such that, in the secure mode, the first and second pair of position sensing switches will close to short circuit the ear and microphone transducers 11 and 12 respectively. The third, fourth, fifth and sixth pairs of switches will be open to disconnect these transducer from the main set (not shown). In the operating mode, at least one switch of each of the first and second pair will be open to remove the short across the transducers. At least one switch of each of the third, fourth, fifth and sixth pair will be closed to reconnect the transducers to the main set.

The receptacles are each generally tubular in shape and aligned generally along the same axis on each longitudinal side. Each receptacle slopes downwardly and is directed forwardly towards end 43 of block 40. The position-sensing switches are each inserted in a receptacle and interconnected as shown in Figures 3 and 4.

Each receptacle has a central axis A which makes an angle a (alpha) with the longitudinal axis B of the mounting block. Similarly, central axis A makes an angle β (Beta) with the lateral axis C of the mounting block.

The mercury switch 50 of Figure 6 can be used as a position-sensing switch. In the preferred

embodiment, the mercury switch should be provided with contact making terminals at one end. This allows the switch to be positioned in the receptacles so as to be either in the open or closed state.

The switch of Figure 6 is generally tubular and has a first end 51 with a pair of terminals 52.

The first switch of each pair is inserted in a receptacle on the first longitudinal side of mounting block 40 and the second switch is inserted in a corresponding receptacle on the second longitudinal side of the mounting block.

For example, the position-sensing switches could be inserted in the mounting block receptacles as follows:

PSS_1 - a
PSS_2 - a′
PSS_3 - b
PSS_4 - b′
PSS_5 - c
PSS_6 - c′
PSS_7 - d
PSS_8 - d′
PSS_9 - e
PSS_{10} - e′
PSS_{11} - f
PSS_{12} - f′

In the secure mode, position-sensing switches PSS_1, PSS_2, PSS_7 and PSS_8 should all be closed so as to short circuit the ear and microphone transducers 11 and 12 respectively.

Accordingly, each switch should be inserted in their respective receptacles with their contact making terminals pointing inwardly.

The remaining mercury switches forming each pair of the third, fourth, fifth and sixth pair of mercury switches are inserted in their respective receptacles with their contact making terminals pointing outwardly. These will accordingly be open when the handset is in the first predetermined orientation corresponding to the secure mode.

Accordingly, in operation, when the handset is pivoted about the microphone end of the handset as shown in Figure 2a, each mercury switch will change state when the handset is moved within a second predetermined range of orientations. For example switches PSS_1, PSS_2, PSS_7 and PSS_8 will change from a closed state to an open one. This being caused by the movement of mercury from one end of the bulb where the contact terminals are located to the other end. Similarly, the remaining mercury switches will change from an open state to a closed state where mercury will flow from one end of the bulb to the opposite end where the contact making terminals are located.

Similarly, when the handset is pivoted sideways, as shown in Figures 2b and 2c, the mercury switches located closest to the point of rotation will change state. For example, if the mounting block shown in Figures 3 and 4 is pivoted about the longitudinal side 46, the mercury switches on that side of the mounting block i.e. those in receptacles a′ to f′ will change state. Mercury will flow from the end of the switch pointing inwardly to the other end pointing outwardly. Switches PSS_2 and PSS_8 will change from a closed state to an open state. Switches PSS_4, PSS_6, PSS_{10} and PSS_{12} will change from an open to a closed state.

With the change of state of switch PSS_2 and PSS_8, the short across the ear and microphone transducers will be removed. Similarly, with the change of state of switch PSS_4, PSS_6, PSS_{10} and PSS_{12}, the terminals of each transducer will be reconnected.

Similarly, when the mounting block 40 is pivoted sideways about longitudinal side 45, the mercury switches in receptacles a to f will change state.

Referring now to Figure 7, we have shown a sectional view of a receptacle used for retaining a mercury switch. Each receptacle is provided with a number of flexible ridges 60 secured at one end to the inner wall 61 of the receptacle. Each rib extends longitudinally along the length of the receptacle as can be more clearly shown in Figure 8.

Figure 8 is a sectional view of a receptacle taken along line 8-8 of Figure 7. When a mercury switch is inserted in a receptacle, the ribs 60 will flex to allow the bulb to be removably secured therein. This permits the proper positioning of a mercury bulb.

Referring now to Figure 9, we have shown a mounting block according to another embodiment of the present invention. The mounting block 70 is designed so as to be used with the MERIDIAN (trademark) type business set. The mounting block is slightly curved along the longitudinal axis in order to allow easy insertion in the handset. In addition, a series of grooves 71 and 72 allows the proper lining of leads running from a first mercury switch to another. In particular, these grooves are used for the leads interconnecting mercury switches PSS_1 to PSS_2 and switches PSS_7 to PSS_8.

In the preferred embodiment, the angle (alpha) the central axis A makes with the longitudinal axis B of the mounting block is 60°. The angle β (Beta) the central axis A makes with the lateral axis C of the mounting block is 18°.

In the preferred embodiment, the handset will be in the secure mode (all connections from the handset cord to the microphone and ear transducers are open and a short is placed across the ear and microphone transducers) when the handset is laying on a flat table. Lifting the ear end of the handset up while maintaining table contact with the microphone end at any angle less than 9°, the

secure mode will be maintained (see Figure 2a). The operational mode (all transducers connect to the handset card and all shorts removed) occurs in the range of 9° to 52°. The operational mode is maintained at any angle greater than 52°.

Similarly, while holding the left side of the handset on the table and lifting the right side (see Figure 2b), the secure mode is maintained at angles below 11°. The switch from secure to operational mode will occur in the range of 11° to 37°. The operational mode is maintained at angles greater than 37°. The same angles for switching will apply for lifting the left side of the handset while holding the right side.

Referring now to figure 10, we have shown a partially sectioned perspective view of a secure handset according to the preferred embodiment of the present invention. A switching module 100 is disposed in a typical handset 101 between the receiver and transmitter ends 102 and 103 respectively. Electrical leads 104 connect module 100 to the ear transducer (not shown) in receiver end 102. Electrical leads 105 are used to connect module 100 to the microphone transducer and the main telephone set through the telephone cord (not shown). The microphone transducer is located at the transmitter end 103.

In figure 11a, we have shown a perspective view of the switching module 100. It is basically comprised of switch mounting block 110 disposed on a circuit board 111. The switching module 100 is positioned in the handset as is shown in figure 10 with end 119a pointing towards the ear transducer 102 and end 119b pointing towards the microphone transducer 103. The circuit board 111 should face outwardly away from the transducers, i.e. facing the convex side of the handset. Mounting block 110 is comprised of a number of mercury switch receptacles 113 each disposed on an open face of mounting block 110 in a predetermined orientation. This predetermined orientation is similar to that offered by mounting blocks 40 and 70 of figures 3 and 9. That is, the first and last pair of mercury switches 115a, 115b and 116a, 116b have their contact terminals pointing inwardly towards the center of the block whereas the remaining pairs have their contact terminals pointing outwardly. Recess 117 and 118 through mounting block 110 allow the terminals of the first and last pair of mercury switches to reach the printed circuit board 111.

In figure 11b, we have shown the switching module without the mercury switches. Each receptacle 120 has a curvilinear cavity 121 which slopes upwardly inwardly. This inclination is similar to that of mounting block 40 shown in figure 4, i.e. 18° from an horizontal plane. Similarly, the angle the central axis of each receptacle makes with the longitudinal axis of the mounting block is 60°.

Figure 11c is a bottom view of the module 100 showing the printed circuit board 111. The mounting block 110 is positioned on a printed circuit board 111 and secured thereto by means of fasteners 130. Board 111 has a circuit pattern 131 formed in a predetermined design to permit contact terminals 114 of each mercury switch to be electrically connected thereto. The terminating points 132 generally located in the central region of board 111 are used for soldering contact terminals of the mercury switches. Terminating points 133 are used to connect the module 100 to the ear transducer whereas terminating points 134 are used to connect the module to the microphone transducer (not shown). Terminating points 135 and 136 connect the module to the main set via the telephone cord (not shown). With the switches soldered in place, the circuit pattern 131 basically represents the block diagram arrangement of figure 1.

Figure 11d is a partially sectioned view of the support arrangement for the mounting module 100. The support is provided by means of a pair of elongated members 140 positioned longitudinally in said handset and a pair of supporting blocks 141 for retaining module 100 within the handset. The open rectangular shaped supports 141 are adapted to mate with the rectangular shaped protrusions 122 and 123 shown in figures 11a and 11b. This support arrangement will secure the mounting module in the handset while still permitting easy removal and installation.

Claims

1. A security device for use with a telephone handset (30) having a microphone transducer (12) and an ear transducer (11), adapted to prevent eavesdropping while the handset is in an on-hook position, said security device comprising

first switching means (PSS_1,PSS_2;PSS_7,PSS_8) formed by position-sensing switches and connected across said ear and microphone transducers,

second switching means (PSS_3-PSS_6;PSS_9-PSS_{12}) formed by position-sensing switches and connected in series with said ear and microphone transducers such that when said handset is placed within a first predetermined orientation, corresponding to a secure mode, said first switching means becomes closed, shorting said ear and microphone transducers, and said second switching means becomes open, and when said handset is placed within a second predetermined orientation, corresponding to an operating mode, said first switching means becomes open to enable said ear and mi-

crophone transducers, and said second switching means becomes closed, and

a switch mounting assembly (100) comprised of a mounting block (110) disposed on a circuit board (111), said assembly being disposed in said handset and adapted to retain each of said position-sensing switches in a predetermined position.

2. A security device as claimed in claim 1, wherein said position-sensing switches (50;115a,115b,116a,116b)comprise mercury switches.

3. A security device as defined in claim 2, wherein each of said mercury switches is generally tubular with contact-making terminals (51,52;114) at one end thereof.

4. A security device as defined in any of the claims 1 to 3, wherein said first switching means comprises a first set of position-sensing switches (PSS_7,PSS_8) and a second set of position-sensing switches (PSS_1,PSS_2) connected across said microphone transducer and said ear transducer, respectively, said second switching means comprises a third and a fourth set of position sensing switches, each connected in series with a first and a second terminmal (23,24), respectively, of said microphone transducer, and a fifth and a sixth set of position-sensing switches, each connected in series with a first and a second terminal (18,20), respectively, of said ear transducer, and said mounting block is comprised of a plurality of receptacles (120), each adapted to receive a position-sensing switch in said predetermined position such that said first and second set of switches are closed and said third, fourth, fifth and sixth set of switches are open when said handset is in said secure mode and at least one switch of each of said first and second set is open and at least one switch of each of said third, fourth, fifth and sixth set is closed when said handset is in the operating mode.

5. A security device as defined in claim 4, wherein a number of receptacles are positioned along a first longitudinal side of said mounting block and a corresponding number of receptacles are positioned along a second longitidunal side of said mounting block, each longitudinal side being parallel to said longitudinal axis of said handset, such that a first end of said mounting block points toward a receiver end (102) of said handset and a second end of said mounting block points toward a microphone end (103) of said handset.

6. A security device as defined in claim 5, wherein each of said first, second, third, fourth, fifth and sixth set is comprised of a pair of mercury switches, a first switch in each pair being positioned in a receptacle along said first longitudinal side of said mounting block, a second switch in said pair being positioned in a corresponding receptacle along said second longitudinal side of said mounting block, the mercury switches (115a,115b,116a,116b) of said first and second set being so mounted in said receptacles that the contact-making terminals thereof point inwardly and generally toward said first end of said mounting block, and the mercury switches of said third, fourth, fifth and sixth set being so mounted in said receptacles that the contact-making terminals (114) thereof point outwardly and generally away from said first end.

7. A security device as defined in claim 5 or 6, wherein said receptacles (120) are disposed on an open face of said mounting block (110), each receptacle having an inclined curvilinear cavity (121) for receiving said mercury switch.

8. A security device as defined in any of the preceding claims, wherein said circuit board (111) is comprised of a circuit pattern (131) formed in a predetermined design to permit contact terminals of said mercury switches to be electrically connected thereto in a predetermined orientation.

9. A security device as defined in any of the preceding claims, wherein said mounting block (110) is formed with protrusions (122,123) adapted to mate with supporting blocks (141) of said handset for removably retaining said mounting assembly (100) in a predetermined position within said handset.

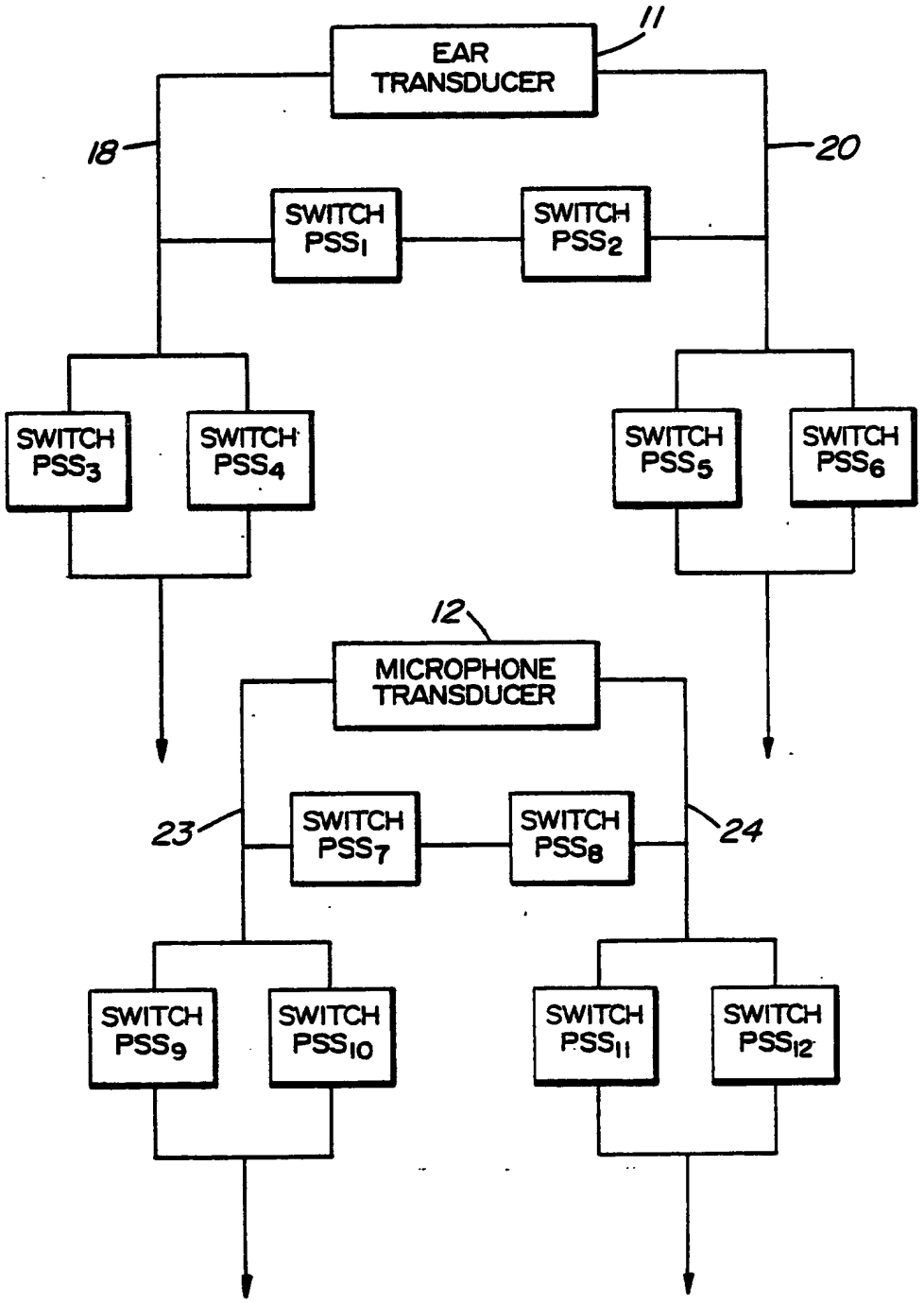
11
EAR TRANSDUCER
18
20
SWITCH PSS1
SWITCH PSS2
SWITCH PSS3
SWITCH PSS4
SWITCH PSS5
SWITCH PSS6
12
MICROPHONE TRANSDUCER
23
24
SWITCH PSS7
SWITCH PSS8
SWITCH PSS9
SWITCH PSS10
SWITCH PSS11
SWITCH PSS12

FIG. 1

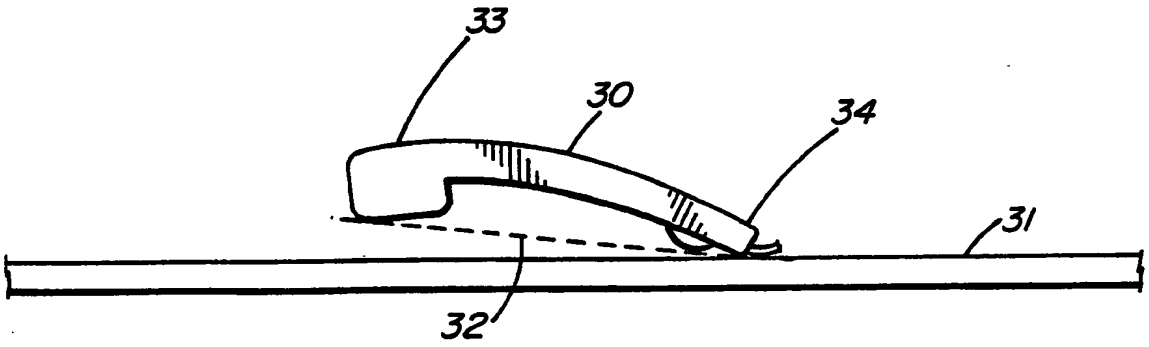

FIG. 2a

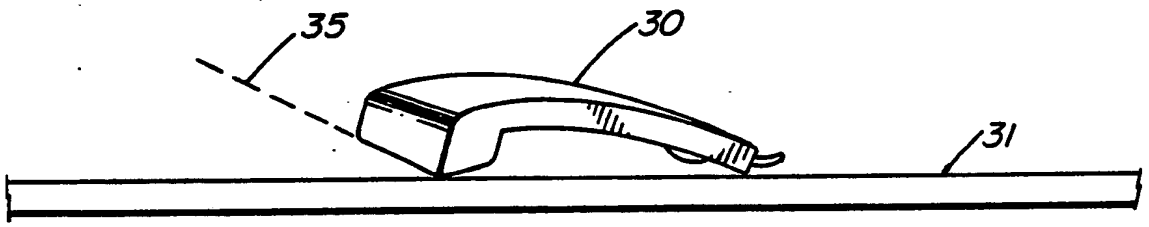

FIG. 2b

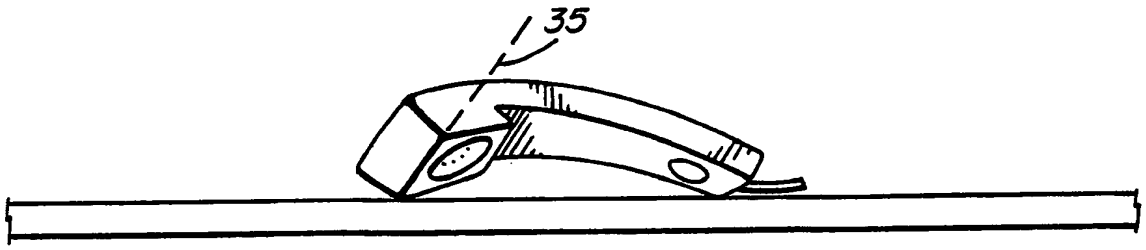

FIG. 2c

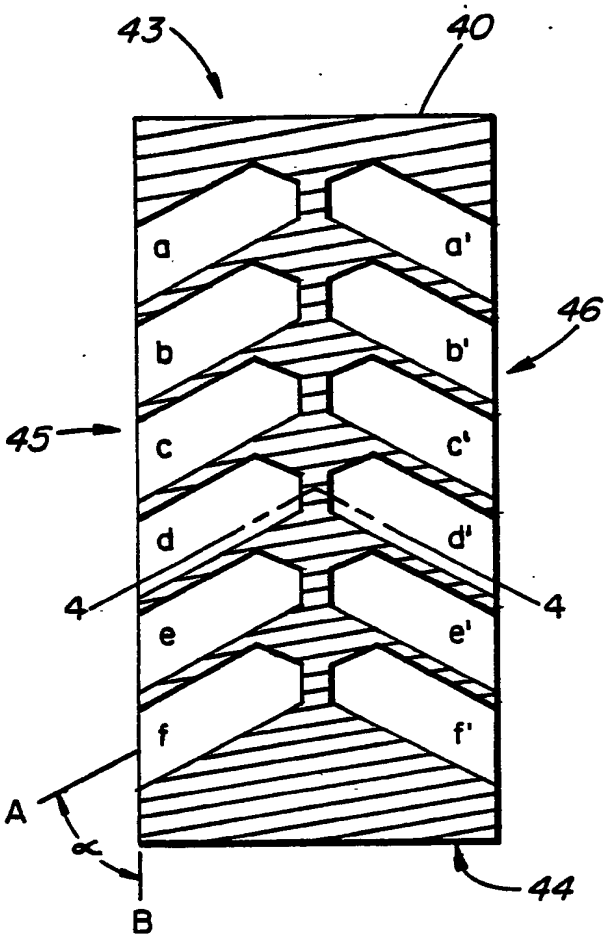

FIG. 3

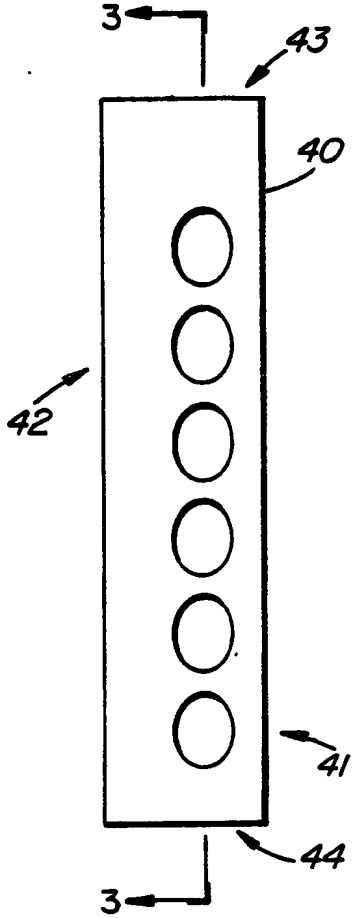

FIG. 5

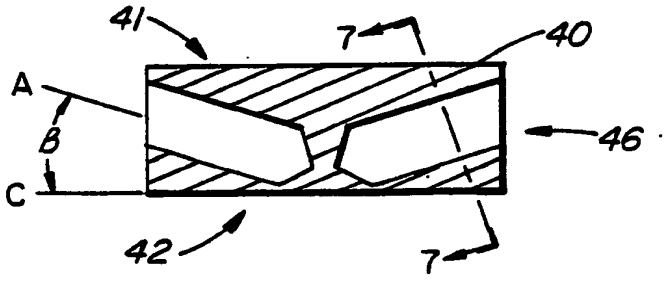

FIG. 4

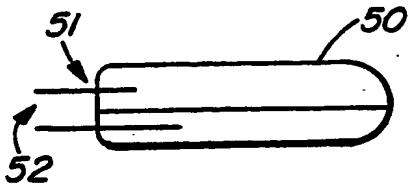

FIG. 6

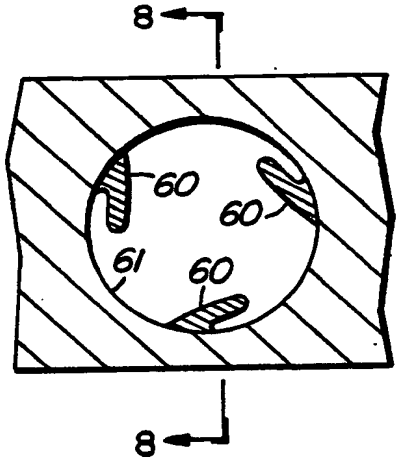

FIG. 7

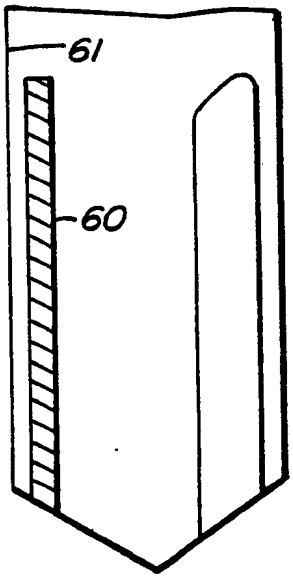

FIG. 8

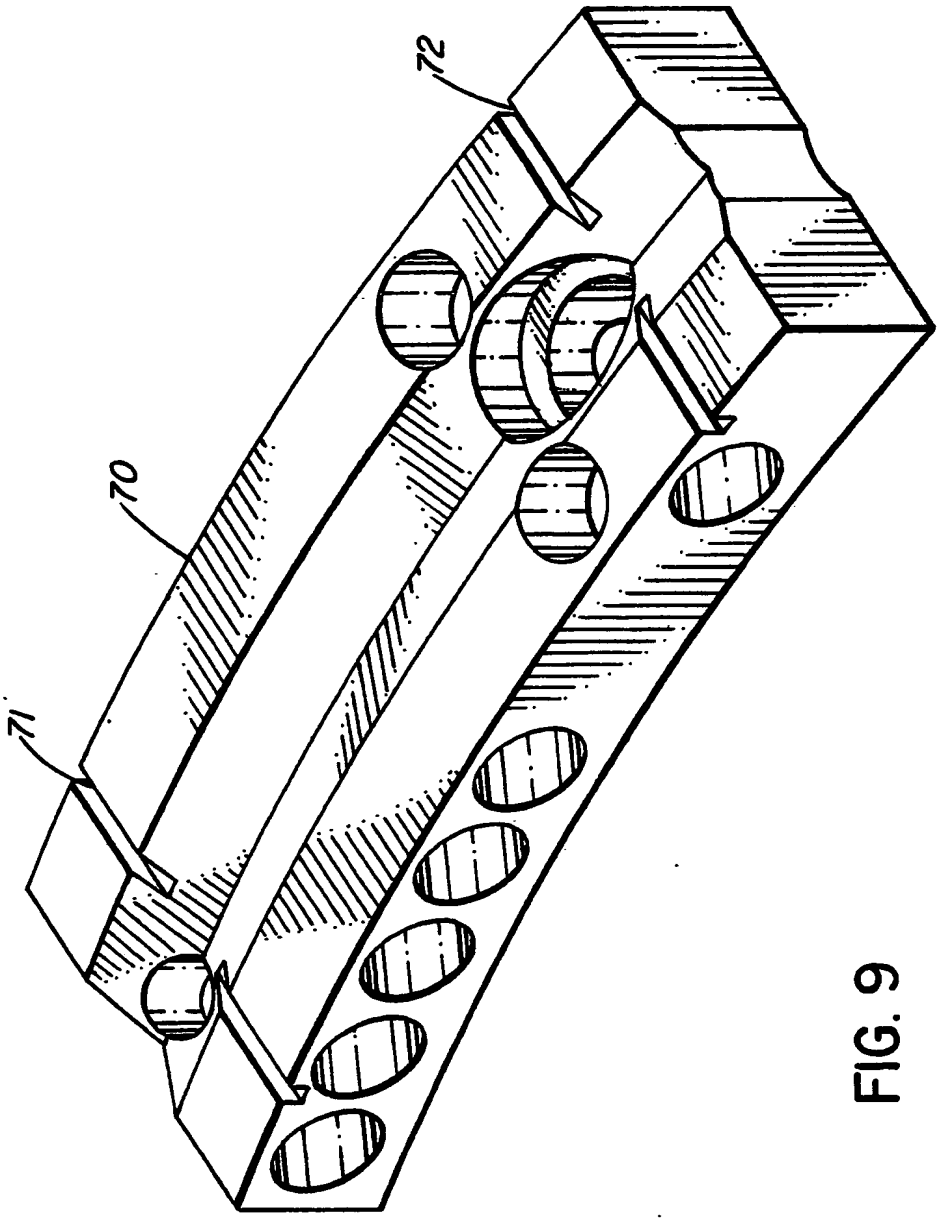

FIG. 9

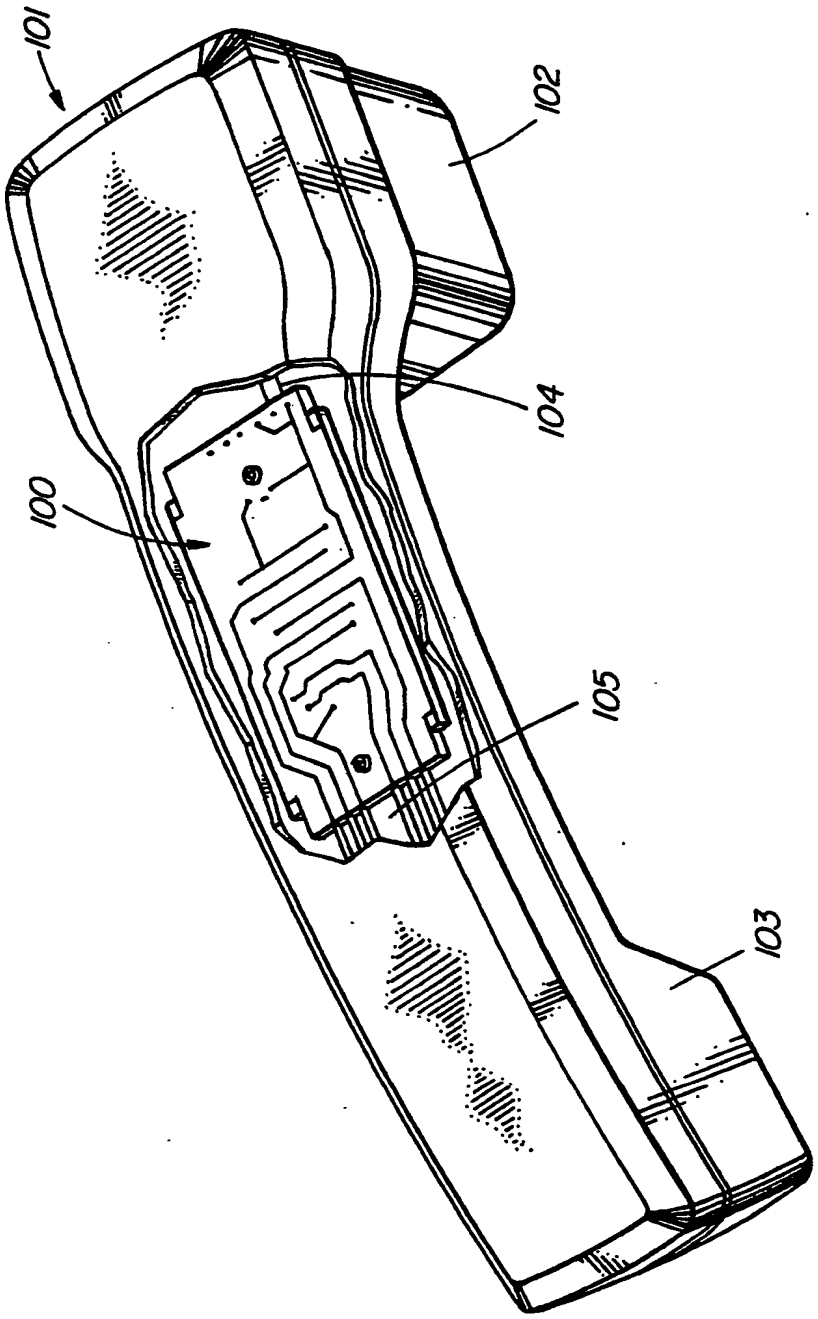

FIG. 10

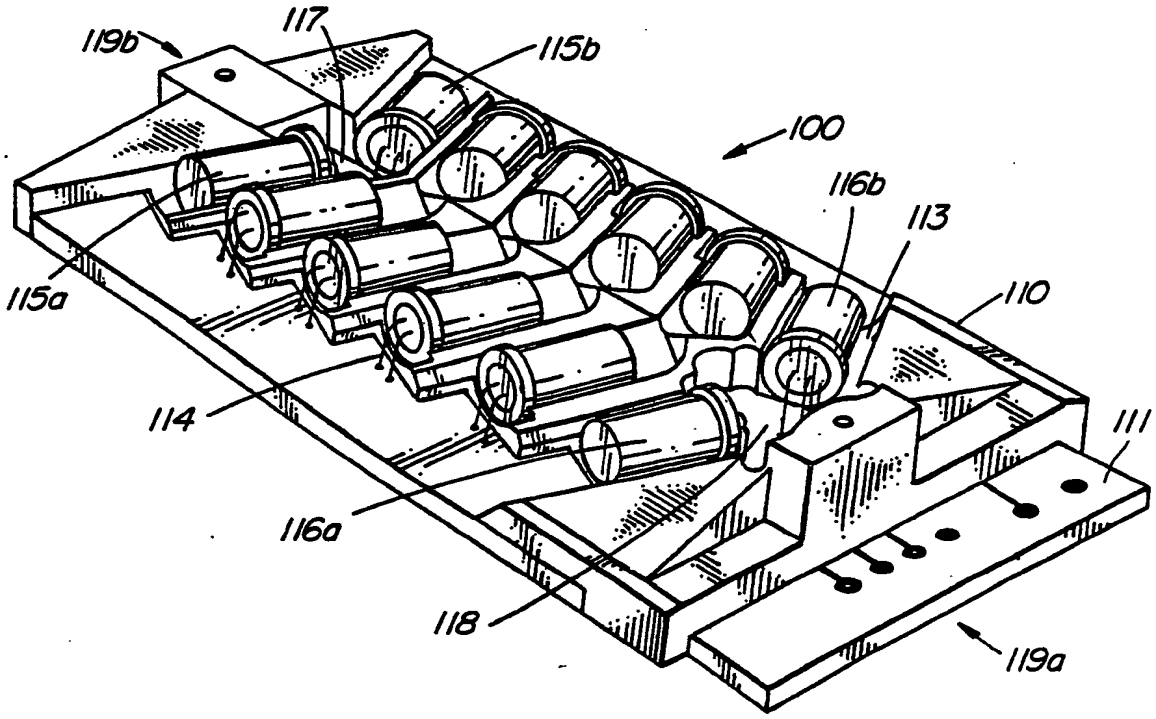

FIG. 11a

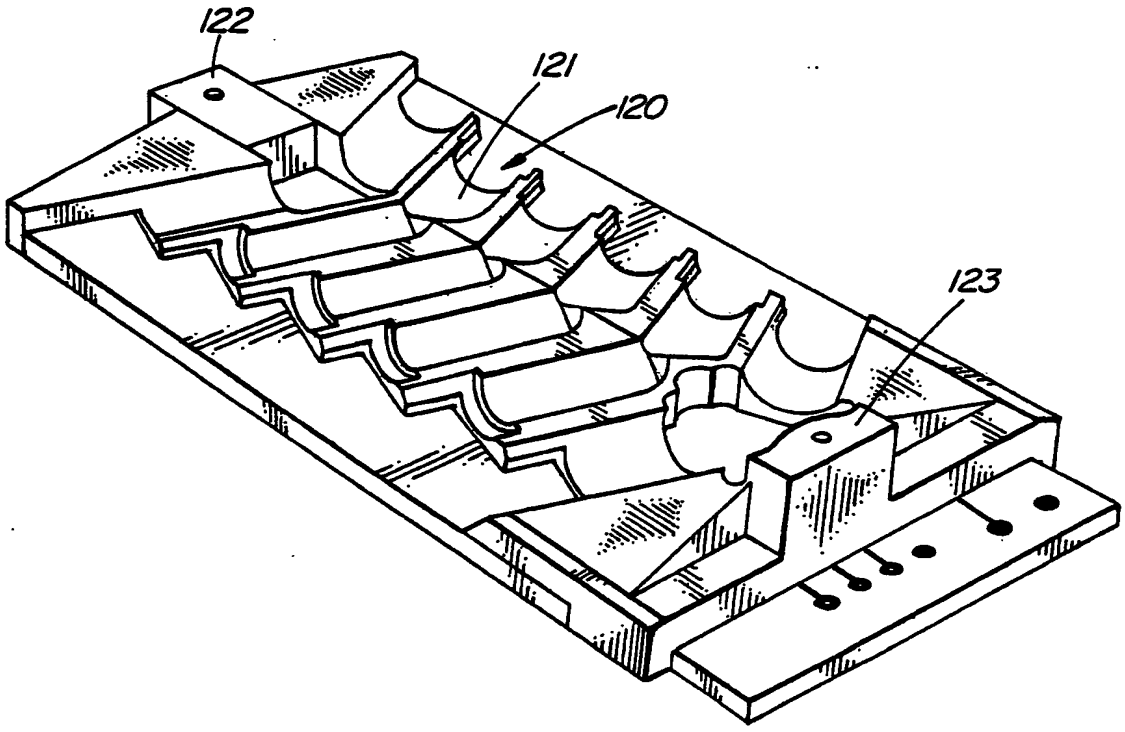

FIG. 11b

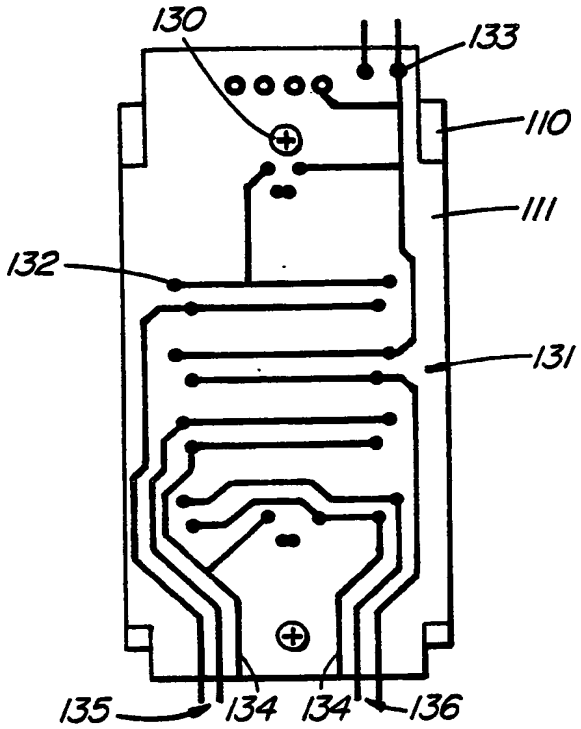

FIG. 11c

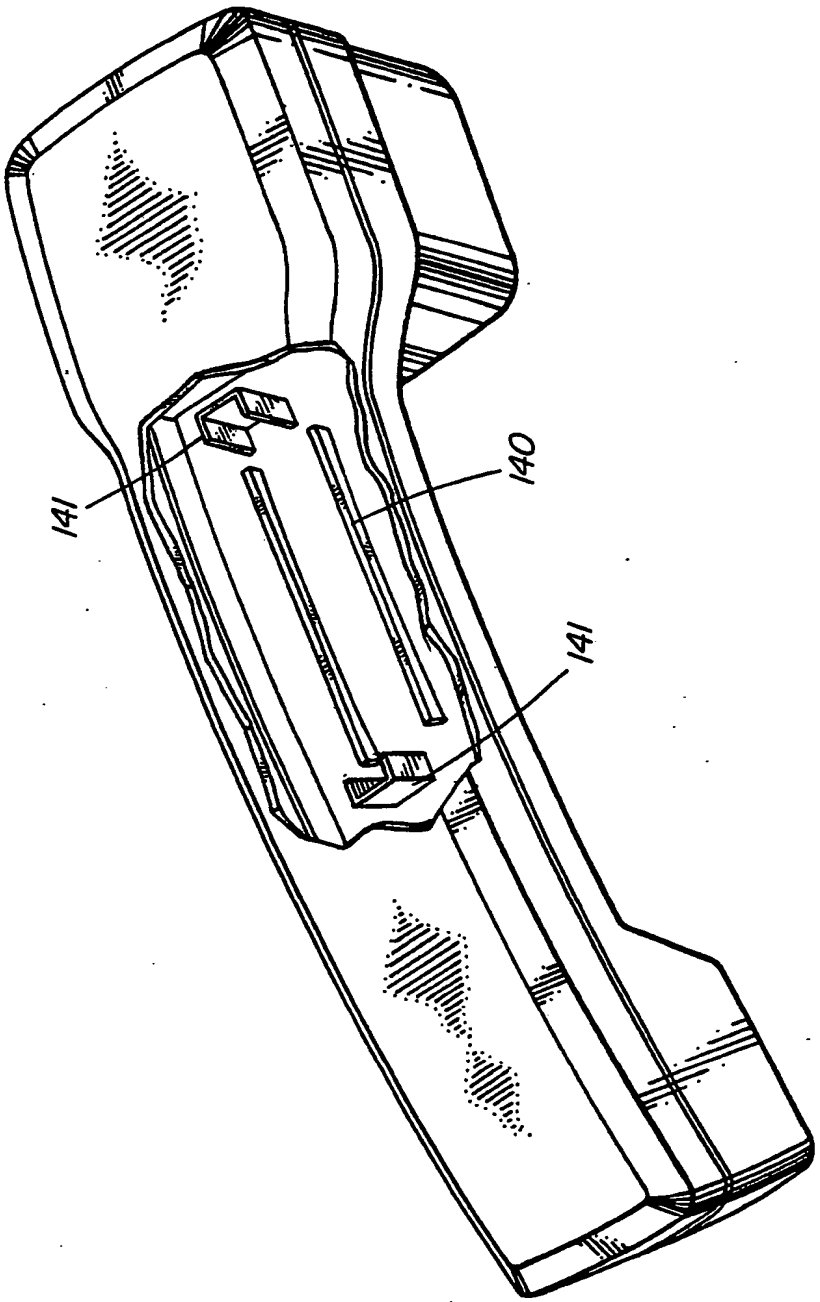

FIG. 11d

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European Patent Office
Office européen des brevets

(11) Publication number: **0 365 741 A3**

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(54) **Security Handset.**

(57) A security device for use with a telephone handset having a microphone and an ear transducer is adapted to prevent eavesdropping while the handset is in an on hook position. The security device is comprised of switching means (115a,115b,116a,116b) disposed in the handset and adapted to disable the transducers. The switching means is switched to a first state when the handset is placed within a first predetermined orientation corresponding to a secure mode and is switched to a second state when the handset is placed within a second predetermined orientation corresponding to an operative mode. The individual switches (115a,115b,116a,116b) forming said switching means are held in position on a switch mounting assembly (100) comprised of a mounting block (110) disposed on a circuit board (111).

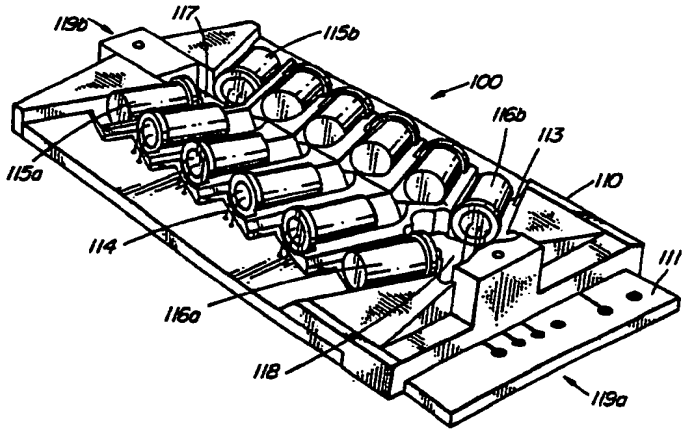

FIG. 11a

EP 0 365 741 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 10 8417

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
E	EP-A-0 319 721 (NORTHERN TELECOM.)(14-06-1989) * Page 2, line 57 - page 5, line 18 *	1-9	H 04 M 1/19 H 04 M 1/68
D,A	US-A-3 715 514 (BELL, Jr.) * Abstract; column 2, line 54 - column 4, line 34; column 5, lines 9-52; column 5, line 63 - column 6, line 4; column 7, lines 30-59; column 8, lines 6-20 *	1,4	
A	FR-A-2 284 256 (SERRES et al.) * Page 1, lines 1-3,15-34; page 2, lines 22-36; page 2, line 40 - page 4, line 36 *	1-4	
A	DE-A-2 915 774 (GROTHE & SÖHNE) * Page 4, lines 1-6; page 8, lines 1-13; page 13, lines 8-13 *	8	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 04 M

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	28 November 90	ZANTI P.V.L.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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E: earlier patent document, but published on, or after the filing date
D: document cited in the application
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